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Title of Invention: Fuel Tank Breather Device

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(54) Title of the Invention: **Fuel Tank Breather Device**

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SPECIFICATION

1. Title of the Invention

Fuel Tank Breather Device

2. Claims

(1) A fuel tank breather device characterized in that a pipe is disposed in the fuel tank, for providing communication between the inside and outside of the fuel tank, wherein a porous film having through holes with a diameter greater than the diameter of fuel vapor but less than the diameter of a droplet is disposed in the pipe so as to cut off the inside and outside thereof.

3. Detailed Description of the Invention

a. Field of Industrial Utilization

The present invention relates to a fuel tank breather device.

b. Prior Art

In fuel tanks, the ceiling portion of the fuel tank is open to the outside of the fuel tank by way of a pipe to prevent blowback during fueling and so that the fuel tank does not deform due to internal pressure caused by expanding fuel vapor.

Figs. 4 and 5 show conventionally adopted breather devices.

The breather device in Fig. 4 is configured with a ball-type check valve 2 disposed in a pipe 3 so that fuel does not flow out of the tank 1 during a vehicle rollover. The ball-type check valve 2 has a ball 2a with a higher specific gravity than fuel that is placed inside a tray 2b so that the ventilation of fuel vapor is unobstructed, and a valve seat 2c formed on the internal peripheral surface of the pipe and positioned above the tray 2b. Therefore, in the normal state of the fuel tank 1, the inside of the tank 1 and the outside of the tank 1 are in communication and fuel vapor is exhausted out of the tank 1, as indicated by the arrow in Fig. 4(a). In the case of a vehicle rollover, the ball 2a becomes seated in the valve seat 2a of the pipe 3, and the pipe 3 is blocked, as shown in Fig. 4(b), preventing fuel from flowing out of the tank 1.

The breather device in Fig. 5 has a floating check valve that intervenes between a tank 5 and a pipe 7 so that fuel does not flow out of the tank 5 when fuel in the fuel tank 5 floods the area around the device due to a change in vehicle orientation, vibration, or other factor while traveling. This floating check valve 6 has a hole 8a in the top wall that is in communication with the pipe 7, a hole 8b in the side wall that is in communication with the top of the tank 1, and holes 8c in the bottom wall that are in communication with the inside of the tank 1[1]. The floating check valve also has a housing 8 in which a valve seat 8d is formed on the periphery of the hole 8a, and a float 9 accommodated inside a chamber 8e of the housing 8. Therefore, when fuel has not flooded the inside of the tank 5, as shown in Fig. 5(a), the float 9 is positioned in the lower portion of the chamber 8e of the housing 8, the top of the tank 5 is in communication with the outside of the tank 5 by way of the holes 8b and 8b and the pipe 7, and fuel vapor is exhausted out of the tank 5, as indicated by the arrow. When fuel has flooded the inside of the tank 5, as shown in Fig. 5(b), the float 9 makes contact with the valve seat 8d, closes the upper opening 8a, and prevents fuel from flowing out of the fuel tank 5.

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[1] Translator's note: Should probably read "tank 5."

c. Problems to Be Solved by the Invention

In the breather device shown in Fig. 4, the fuel in the tank 1 is reliably prevented from flowing out when the check valve 2 is inverted about 180 degrees with respect to the upright state of the check valve 2 shown in Fig. 4(a). However, when the check valve 2 tilts in about 90 degrees, the ball 2a does not always become reliably seated in the valve seat 2c, and there is a chance that fuel could flow out of the tank.

There are also cases in which the float 9 in the breather device shown in Fig. 5 cannot react to the vibrations of the traveling vehicle, and cannot reliably prevent fuel inside the tank 5[2] from flowing out.

In view of the above, an object of the present invention is to provide a fuel tank breather device that can reliably prevent fuel from flowing out of the tank during vehicle rollover, vibration, or other action, and whose structure is very simple.

d. Means Used to Solve the Above-Mentioned Problems

In the fuel tank breather device of the present invention, a pipe is disposed in the fuel tank, for providing communication between the inside and outside of the fuel tank, wherein a porous film having through holes with a diameter greater than the diameter of fuel vapor but less than the diameter of a droplet is disposed in the pipe so as to cut off the inside and outside thereof.

e. Operation of the Invention

The porous film allows fuel vapor to pass, but prevents the passage of fuel. Therefore, in a normal state, when the internal pressure of the fuel tank increases, gas containing fuel vapor passes through the porous film and is exhausted out of the tank, and when the internal pressure of the fuel tank decreases, atmospheric air is introduced through the porous film, and the tank is constantly kept at atmospheric pressure. Also, fuel is prevented from flowing out by the porous film, even if fuel reaches the pipe during vehicle rollover or vibration.

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[2] Translator's note: Should probably read "tank 1."

f. Working Examples

Fig. 1 shows the fuel tank breather device of the present invention, Fig. 2 shows a filter member that is the main member of the device, and Fig. 3 shows the operation of the porous film in the filter member.

In the breather device, a pipe 12 is mounted in the top wall 11a of the fuel tank 11. Pipe 12 is composed of a lower pipe 12a and an upper pipe 12b, and a filter member 13 is held between the pipes 12a and 12b. In the filter member 13, a porous polymer film composed of polytetrafluoroethylene or the like is laminated onto a fabric or another base material 13a, or polyurethane is coated onto a fabric or another base material 13a, and a porous film 13b having numerous pores with a diameter of about 0.5 to 3 μm is formed on the base material 13a.

Therefore, when the internal pressure of the fuel tank 11 increases, gas A containing fuel vapor (diameter: about 0.0004 μm) passes through the porous film 13b of the filter member 13 and is exhausted out of the fuel tank 11; and when the internal pressure of the fuel tank 11 decreases, atmospheric air is introduced into the tank 11 through the porous film 13b, and the tank 11 is constantly kept at atmospheric pressure. Also, even if the vehicle vibrates and gas B reaches the filter member 13, droplets of fuel B (diameter: 100 to 3,000 μm) are prevented from escaping by the porous film 13b, as shown in Fig. 3. Fuel B therefore does not flow out of tank 11. Even if the vehicle rolls over, the flow of fuel B out of the tank is securely prevented by the porous film 13b in the same manner as the case of vibration.

In the above-described working example, fabrics known as Gore-Tex and Entrant (both trademarks) were used as the filter member 13, but in the filter member of the present invention, the configuration may have a large number of pores sufficient to allow fuel vapor to pass and to prevent the passage of droplets, and other fabric features are not required. Materials other than cloth may therefore be used as the base material 13a of filter member 13, and a rigid material may be used. Also, the porous film 13b is not limited to a film molded by using a porous polymer.

g. Effect of the Invention

As described above, the fuel tank breather device of the present invention reliably prevents fuel flowing out of the tank during vehicle vibration and vehicle rollover, and has a very simple structure.

4. Brief Description of the Drawings

Fig. 1 is a conceptual cross-sectional diagram showing the fuel tank breather device of the present invention, Fig. 2 is a perspective view of the filter member used in the device, Fig. 3 is a diagram that shows the operation of the porous film in the filter member, and Figs. 4 and 5 are conceptual cross-sectional diagrams that show a conventional fuel tank breather device and the operation of the device.

11: fuel tank
12: pipe
13: filter member
13a: base material
13b: porous film
A: gas
B: droplets

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Figure 1

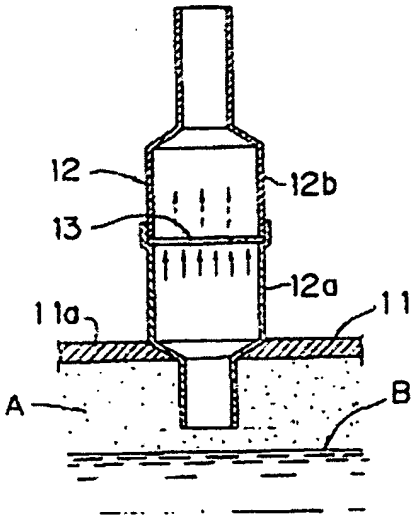

Figure 2

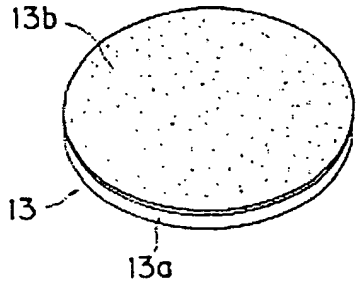

Figure 3

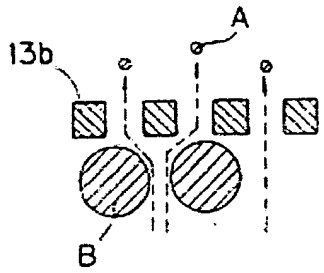

Figure 4

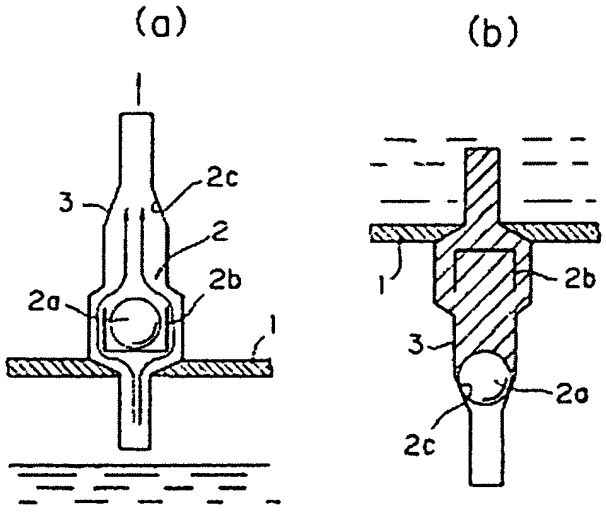

Figure 5